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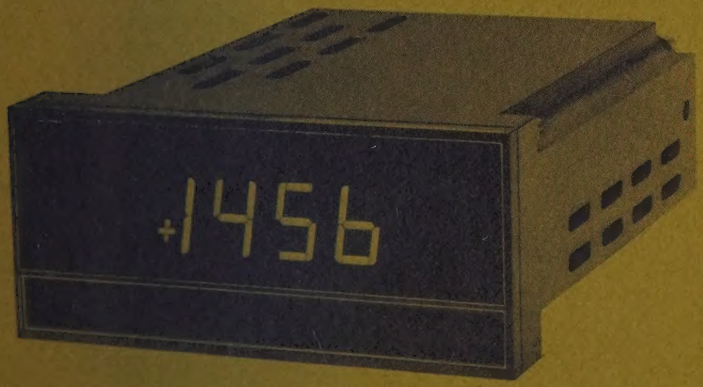


## LINE OPERATED

## DIGITAL PANEL METER

# WESTON 2460 SERIES

## INSTRUCTION MANUAL

INSTRUCTIONS/PARTS LIST
FOR

WESTON 2460 SERIES

E.S.D. INSTRUMENTATION
C.C. 203 MS 145
RM 2250B EXT 2224

# LINE OPERATED

# DIGITAL PANEL METER

U. S. Patent 3,051,939
and other Patents Pending

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**WESTON INSTRUMENTS, INC.**
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# INTRODUCTION

The Weston 2460 Series encompasses several models of high-performance 3½ digit bipolar digital panel meters (DPM's). Based on a custom LSI implementation of Weston's patented Dual Slope Integration* A/D conversion technique, these DPM's feature isolated input and output, high brightness 0.6" LED displays, a selection of input configurations, and a fully interactive systems interface.

2460 Series instruments are furnished in the Weston DPM case⊕ which has become an industry standard. The connector pin assignments duplicate the format originated for Weston's popular model 1230, and presently the only multiple-source pinout in the industry; this assures easy retrofit in existing applications, and assures the availability of alternate sources. The floating input section provides exceptional noise immunity through dielectric isolation from both power input and digital interface sections; either single-ended or balanced differential input configurations may be selected to match application requirements. The low component count, low power consumption, and the absence of limited-life components render these instruments extremely reliable. The two-chip implementation of the LSI circuitry permits extreme flexibility in accommodating special application requirements.

TABLE 1
MODEL CONFIGURATIONS

| Model | Signal Input Type | Digital Interface Rating |
|---|---|---|
| 2461 | Single-ended | LTTL/CMOS |
| 2462 | Single-ended | TTL |
| 2463 | Differential | LTTL/CMOS |
| 2464 | Differential | TTL |

*U.S. Patent 3,051,939
⊕ Meets requirements of U.L. Spec. 94 V 1

# SPECIFICATIONS

| | |
|---|---|
| Resolutions | 0.05% (1:2,000) |
| Standard Sensitivities | 100μV, 1mV |
| Accuracy | ±(0.05% Rdg. ±1 count) |
| Display | 0.6" (15mm) LED, ±1999 |
| Outrange Indication | MSD "1" flashes, other digits blanked |
| Temperature Coefficient: | |
| of Reading | 100ppm/°C max. |
| of Zero | 10μV/°C max. |
| NMRR (standard filter) | 30dB min. |
| CMRR (1,000 ohm unbalance) | 80dB |
| Signal Integration | 16.7mS (117/234VAC) or 20mS (220/240VAC) approx. |
| Measurement Rate | 2 to 3 per second (to 25/sec. via external control) |
| Input Bias Current | 3nA maximum, 0 to 50°C |
| Input Impedance | Per Table 2 |
| Input Overload Protection | 60 volts min. (see Table 2) |
| Common Mode Voltage Rating: | |
| Signal vs Power Input | 500 VAC (1,500VAC optional) |
| Signal vs Digital Common | 200 V Peak |
| Signal vs Analog Common | 3.0 volts (Models 2463 & 2464; 100mV range)<br>1.5 volts (Models 2463 & 2464; 1 volt range) |
| Digital Interface: | |
| BCD Format | 8421 parallel, latched and isolated |
| BCD Fanout | 2 u.l. (TTL), Models 2462 & 2464<br>2 LTTL u.l., Models 2461 & 2463 |
| Outrange | Logical 1 = outrange condition |
| Polarity | Logical 1 = positive input signal |
| Print Command (EOC) | Logical 1 @ data update (pulse) |
| Hold | Logical 0 inhibits new conversions |
| Logic Levels | TTL standard |
| Decimal Activation | Jumper or switch connection to digital ground |
| Operating Ambient | 0 to 50°C/10 to 85% R.H. |
| Storage Ambient | -55° to +85°C/0 to 95% R.H. |
| Power Requirements | 117/234 or 220/240VAC, 50 to 400Hz, 3.5Watts |
| Dimensions | Per Figure 1 |
| Weight | 13 oz (370 g) approx. |

## TABLE 2
## TABLE OF SPECIFICATIONS

| Range ⊕ | Input Impedance | CATALOG NUMBERS | | | Maximum Overload |
|---|---|---|---|---|---|
| | | 117 VAC | 220 VAC | 240 VAC | |
| Model 2461: Single-ended Input, CMOS/LTTL Systems Interface | | | | | |
| 0 to 100mV | 100M Ohms | 0278383 | 0278399 | 0278415 | 60V |
| 0 to 1V | 100M Ohms | 0278384 | 0278400 | 0278416 | 60V |
| 0 to 10V | 5M Ohms | 0278385 | 0278401 | 0278417 | 600V |
| 0 to 100V | 5M Ohms | 0278386 | 0278402 | 0278418 | 1000V |
| Model 2462: Single-ended Input, TTL Systems Interface | | | | | |
| 0 to 100mV | 100M Ohms | 0278387 | 0278391 | 0278407 | 60V |
| 0 to 1V | 100M Ohms | 0278388 | 0278392 | 0278408 | 60V |
| 0 to 10V | 5M Ohms | 0278389 | 0278393 | 0278409 | 600V |
| 0 to 100V | 5M Ohms | 0278390 | 0278394 | 0278410 | 1000V |
| Model 2463: Differential Input, CMOS/LTTL Systems Interface | | | | | |
| 0 to 100mV | 100M Ohms | 0278375 | 0278403 | 0278419 | 60V |
| 0 to 1V | 100M Ohms | 0278376 | 0278404 | 0278420 | 60V |
| 0 to 10V* | 5M Ohms | 0278377 | 0278405 | 0278421 | 600V |
| 0 to 100V* | 5M Ohms | 0278378 | 0278406 | 0278422 | 1000V |
| Model 2464: Differential Input, TTL Systems Interface | | | | | |
| 0 to 100mV | 100M Ohms | 0278379 | 0278395 | 0278411 | 60V |
| 0 to 1V | 100M Ohms | 0278380 | 0278396 | 0278412 | 60V |
| 0 to 10V* | 5M Ohms | 0278381 | 0278397 | 0278413 | 600V |
| 0 to 100V* | 5M Ohms | 0278382 | 0278398 | 0278414 | 1000V |

*Differential input versions with attenuated inputs are not balanced with respect to analog common

⊕ 100% overrange on all ranges.

# MECHANICAL INSTALLATION

## GENERAL

Figure 1 shows a pictorial view and overall dimensions of the DPM.

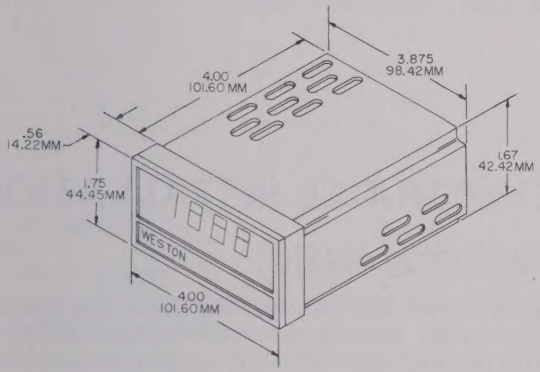



**Figure 1. Outline Dimensional Drawing**

## PANEL PREPARATION

Prepare a panel cutout at the desired mounting location in accordance with Figure 2. If panel thickness exceeds 0.375" (9.5mm), it may be necessary to reverse the axial orientation of the four panel retaining clamps located just behind each corner of the DPM case flange.

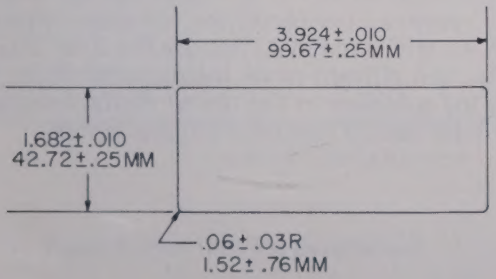



**Figure 2. Panel Cutout Dimensions**

### DPM INSTALLATION

Remove the DPM front bezel by inserting a blade or screwdriver tip near a corner and gently prying bezel off. Loosen panel retaining clamps by rotating each associated screw 3-4 turns counterclockwise. Install the DPM from the panel front, being sure that each clamp clears the panel rear surface. Rotate clamp adjusting screws clockwise until DPM is secure.

## ELECTRICAL INSTALLATION

### INPUT CONNECTOR WIRING

A mating connector with appropriate mounting screws is available from Weston under catalog number 9790-0267253; the connector is ELCO p/n 00-6007-030-980-002, Amphonel p/n 225-21524-601 (117) or equal. The polarizing key should be located between pins 5 and 6 to prevent misapplication and possible damage to the DPM.

Connect operating power, input signal, and any digital input/outputs which are to be used, according to the location guide provided as Table 3. Note that the ground associated with signal inputs (Pin B) is distinct from that of the digital interface (Pin N). In differential input models (2463, 2464), a separate "Analog Common" connection is required at Pin B. Higher voltage ranges are effected by use of a resistive attenuator; for full-scale ranges above 1 volt, apply SIGNAL HIGH to Pin A, but use Pin 2 for SIGNAL HIGH in 100mV, 1V, and current-range instruments. Refer to the following section for guidance in the use of digital interface signals, and for further information concerning signal inputs.

## TABLE 3
## CONNECTOR PIN ASSIGNMENTS

| | | | |
|---|---|---|---|
| 1. | +12 Test Point* | A. | SIGNAL HIGH (ATTENUATOR) |
| 2. | SIGNAL HIGH (DIRECT) | B. | ANALOG COMMON ▽ |
| 3. | PRINT (EOC) | C. | OUTRANGE |
| 4. | POLARITY | D. | HOLD INPUT |
| 5. | BCD 8 | E. | BCD 1 |
| 6. | BCD 2 | F. | BCD 4 |
| 7. | BCD 80 | H. | BCD 10 |
| 8. | BCD 20 | J. | BCD 40 |
| 9. | BCD 800 | K. | BCD 100 |
| 10. | SIGNAL LOW | L. | D.P. 3 (XX.X)* |
| 11. | BCD 400 | M. | D.P. 2 (X.XX)* |
| 12. | BCD 200 | N. | DIGITAL GROUND ⏚ |
| 13. | EXT. SYNC. INPUT* | P. | D.P. 1 (.XXX)* |
| 14. | BCD 1000 | R. | TRANSFORMER SHIELD ⏦ |
| 15. | POWER INPUT (HIGH) | S. | POWER INPUT (LOW) |

* Pins so identified may be assigned alternate functions in OEM Special versions. Such units do not show catalog numbers on the case label.

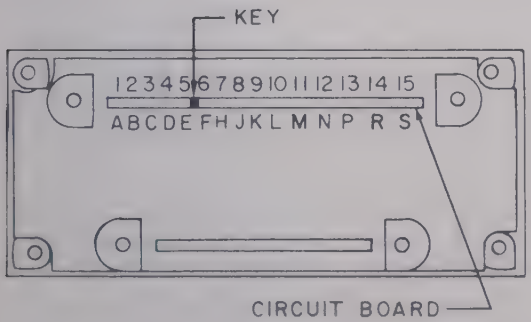



**Figure 3. Rear View Pin Designations**

# APPLICATION OF 2460 SERIES DPM'S

## USING THE SYSTEMS INTERFACE

Each model in the 2460 Series includes an isolated systems interface which includes control inputs, status outputs, and latched, parallel BCD lines corresponding to the current display quantity. The format selected for this digital interface provides the concurrent benefits of simple application characteristics and widespread popularity, as evidenced by the large number of DPM's using the same connector type and pin assignment. The following comments describe pertinent characteristics of each signal in the systems interface.

**Decimal Selection.** Activation of display decimals requires that the appropriate connector terminal (see Table 3) be connected to Digital Ground, pin N. This connection may be made via jumper, switch contacts, or transistor switches rated at 50 milliamperes minimum.

**BCD Data:** At the completion of each new A/D conversion, the digital number corresponding to the applied signal is placed into internal storage registers in the LSI digital chip. A time-division multiplexer encodes this information at a rapid scan rate for application to the DPM display section. Simultaneously, the stored number is presented in parallel BCD form for external use. The 8-4-2-1 BCD code is provided, since most peripherals accept this code without modification. Thus four lines are used to represent each digit in the stored measurement result, resulting in a total of 1 3 lines for data output (3 full digits plus the overrange "1"). This data remains stable between measurements, and is updated only at the completion of the following A/D conversion. A timing pulse (PRINT COMMAND) is presented at connector Pin 3 at the time of BCD update. This pulse is positive-going (i.e., logical 1), and may be used to synchronize external usage of new BCD data. PRINT COMMAND pulse width is approximately 1 msec.

Input signal polarity is represented digitally by a signal at connector Pin 4, POLARITY, and exhibits the logical 1 state for positive input signals. Like the BCD data, this signal is latched so that it changes only at the time of the PRINT pulse. A "1" signal at Pin C of the connector, OUTRANGE, indicates the presence of an input signal beyond the capacity of the DPM.

**Control Inputs:** To facilitate DPM control by external equipment, two digital control inputs are provided. The HOLD input (Pin D) may be used to prevent initiation of subsequent measurements, so that current display and BCD data remains unchanged as long as HOLD is activated. This input responds to a logical 0 or grounding (to digital ground, Pin N), and permits normal operation when driven with a logical 1 signal or open circuit. Where mechanical switch contacts are used to control the HOLD input, it may be necessary to install a small capacitor (i.e., 0.05μF@ 10V) in parallel with the switch to absorb noise spikes generated by switch closure.

The second control input provided is labelled "EXT. SYNC.", and permits the application of an external logical 1 pulse each time a new conversion is desired. Proper utilization of the EXT SYNC input requires that the HOLD input be activated ("0") so that INTERNAL SYNC signals are disabled. The "Ext. Sync." pulse should be between 100μ Sec and 10m Sec wide, and should have a rise time of 10 microseconds or less and fall time of 100 microseconds or less.

**Fanout:** The Models 2461 and 2463 have digital outputs which are derived directly from the CMOS logic chip. These signals will drive 5 volt CMOS or low-power (LTTL) inputs (2 unit loads), but are not capable of driving standard TTL inputs. Models 2462 and 2464 have buffers installed in the output lines so that standard TTL inputs (2 TTL u.l*.) may be driven. Application of the unbuffered Model 2461/2463 outputs to standard TTL inputs will result in excessive loading of the DPM, with the result that some output signals will fall between the limits assigned to the TTL logical 1 and logical 0 states. Thus external equipment will be unable to interpret output data correctly.

* 1 TTL unit load = 40μA in "1" state
= 1.6mA in "0" state
1 LTTL unit load = 5μA in "1" state
= 200μA in "0" state

## USING THE FLOATING INPUT

The floating input section provided in 2460 Series DPM's allows their application in many situations not practical for convention DPM's. Since the signal input section is fully isolated from other DPM circuitry, there is no possibility for the existence of trouble-

some ground-loop currents along signal and digital output leads. Moreover, the "noisy" digital signals on the systems interface lines are prevented from interaction with low-level signal input lines. Further versatility is gained due to the inability of certain types of signal sources, as well as some digital interfaces, to tolerate direct interconnection of signal and system grounds.

**Single-Ended Inputs:** Models 2461 and 2462 are equipped with conventional SINGLE-ENDED input circuits. In this type of input, one signal lead is connected to the ground (common) of the circuit under measurement, while the second signal lead is applied to the point at which the unknown signal exists. In the case of current ranges, the DPM input is placed in series with the current to be measured, observing the convention that a positive reading corresponds to a conventional current flowing into the HIGH signal lead (i.e., connector Pin 2).

**Differential Inputs:** Models 2463 and 2464 have balanced differential inputs. (Note: when fitted with an input attenuator to effect higher full-scale ranges, these inputs are no longer balanced with respect to analog common). The input connection then involves three wires—analog common, plus the two active inputs. The 2460 Series analog circuitry will tolerate common mode voltages of up to 3.5 volts (i.e., between either low-level input and analog common) before accuracy is degraded. Thus a 100mV instrument can be used to measure voltage differences in the range 0-199.9mV, even where both of the points in question have absolute voltage levels of up to 3.3 volts with respect to analog ground. NOTE: the 3.5 volt constraint applies equally to both HIGH and LOW direct signal inputs, and represents the boundary of IN SPEC performance. Permanent damage to the input circuit will not occur unless one or both direct input terminals are driven more than 60 volts with respect to analog common, or have more than 60 volts applied between them.

**Input Attenuators:** Full-scale ranges greater than 2 volts require the use of a resistive voltage divider at the DPM input, so that the A/D converter can be operated within its limits. In catalog versions, a 5 megohm attenuator is used, since this value represents an adequate compromise between the need for high input impedance and the tendency of practical resistors to have larger temperature coefficient of resistance with larger values. The 0.05% error budget precludes the use of resistors having large "tempco's".

Where special ranges are required to reflect "Engineering Unit" display quantities, the attenuator permits ready adaptation of a standard unit to the requirement. By varying the bottom section of the input attenuator, it is possible to achieve a broad range of sensitivities. In calculating the necessary value for this resistor (R102), bear in mind that 100m V at the attenuator output tap will produce 1000 counts in display with split pad "P" bridged.

**External Attenuators:** Where an external attenuator is to provide the DPM input signal, the 0-100mV range should be selected. This permits the use of low impedance taps on the attenuator, and so minimizes the likelihood of offsets due to input bias current. It is best to hold the output impedance of the attenuator below 100K for optimum performance.

# CALIBRATION

1. Apply operating power and allow 30 minute warmup for maximum accuracy.
2. Remove the DPM front bezel (see "DPM Installation") to gain access to zero and calibration controls.
3. Short the signal input leads and turn R-117 zero adj. (see Figure 4) clockwise to produce a small positive reading. Now adjust R-117 counter-clockwise to the point where the "+" sign switches to "–".
4. Apply a calibrated signal (±0.01%) equivalent to a reading of 1900 on the DPM, and adjust R-116 (Full Scale adj.) to produce the desired display reading. The instrument is now properly calibrated.

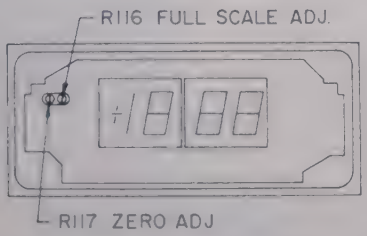



**Figure 4. Calibration Controls**

# THEORY OF OPERATION

The 2460 Series Digital Panel meters utilize a dual slope integrating technique which converts the input signal into a ratio of two time intervals, both proportional to clock period, making the accuracy of conversion independent of clock accuracy.

These digital panel meters use an integrated circuit pair consisting of a digital and linear chip, and the associated interface circuitry to perform the A/D conversion. Refer to the block diagram Figure 5 and waveforms Figure 6.

The integrating cycle is divided into two intervals, signal ramp down $T_1$ and reference ramp up $T_2$. During time $T_1$, which is fixed, a current proportional to the input signal is applied to the integrating capacitor causing it to discharge from its normal positive voltage level by an amount

$$\frac{i_1 \ T_1}{C}$$

At the end of $T_1$ the input signal current is switched out and a reference current is switched in which charges the integrating

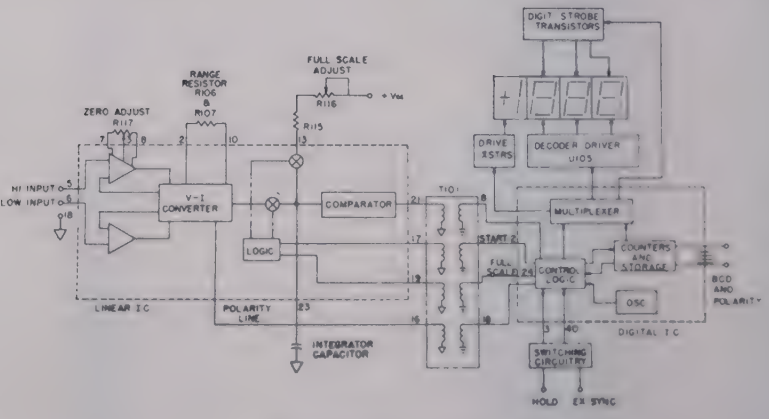



**Figure 5. Block Diagram**

capacitor back to its original level. The time taken to do this is $T_2$ and the amount of voltage restored to the capacitor is

$$\frac{i_{ref}\ T_2}{C}$$

Equating these voltages

$$\frac{i_1\ T_1}{C} = \frac{i_{ref}\ T_2}{C}$$

$$i_1\ T_1 = i_{ref}\ T_2$$

Since the clock frequency is the same for $T_1$ and $T_2$, the number of pulses occurring during these intervals will be in similar ratio.

$$i_1\ N_1 = i_{ref}\ N_2$$

$N_1$ is fixed at 2000 counts

$$i_1\ 2000 = i_{ref}\ N_2$$

$$N_2 = 2000\ \frac{i_1}{i_{ref}}$$

The count $N_2$ is proportional to input voltage.

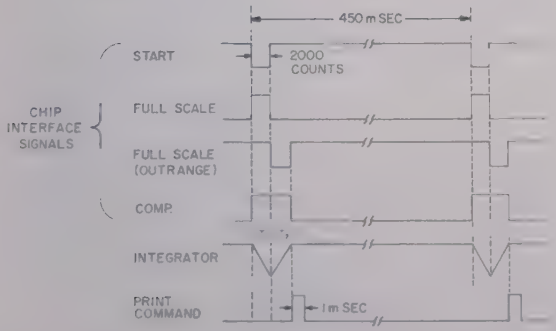
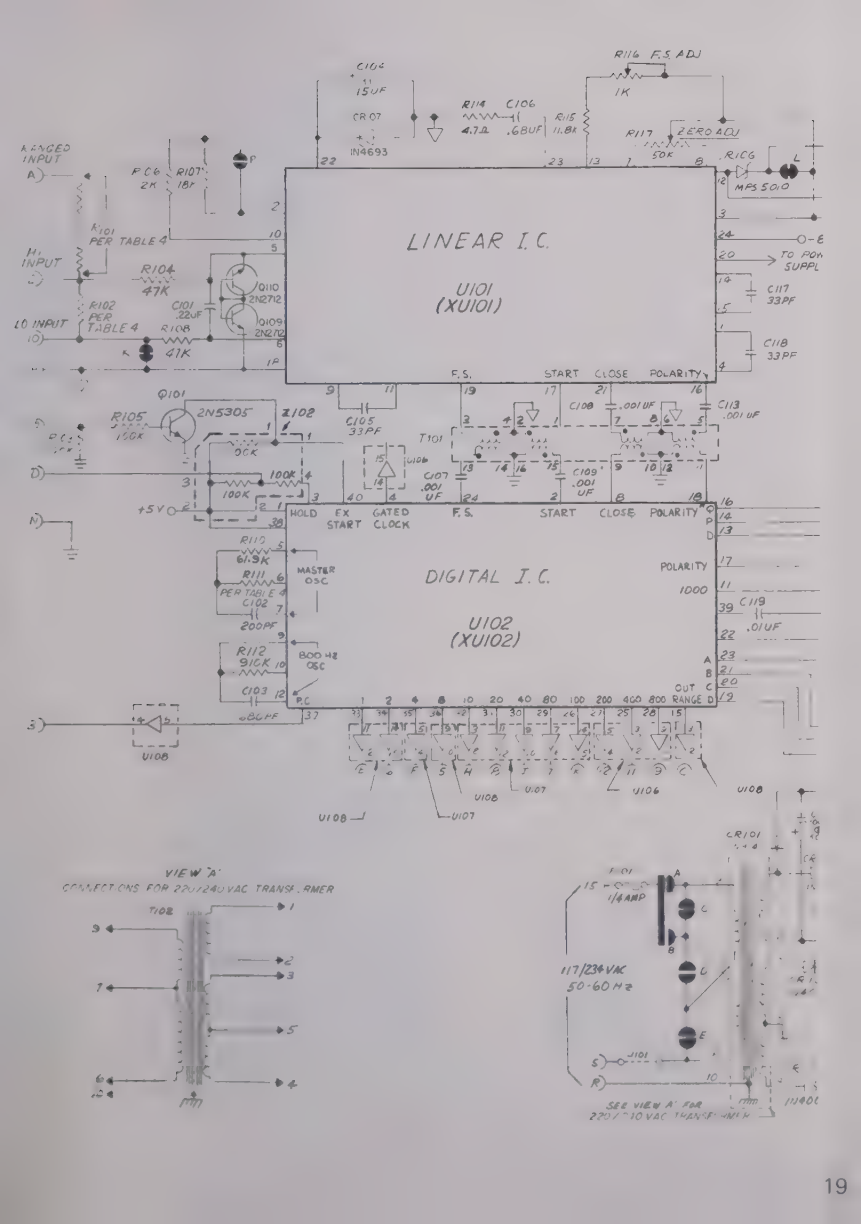
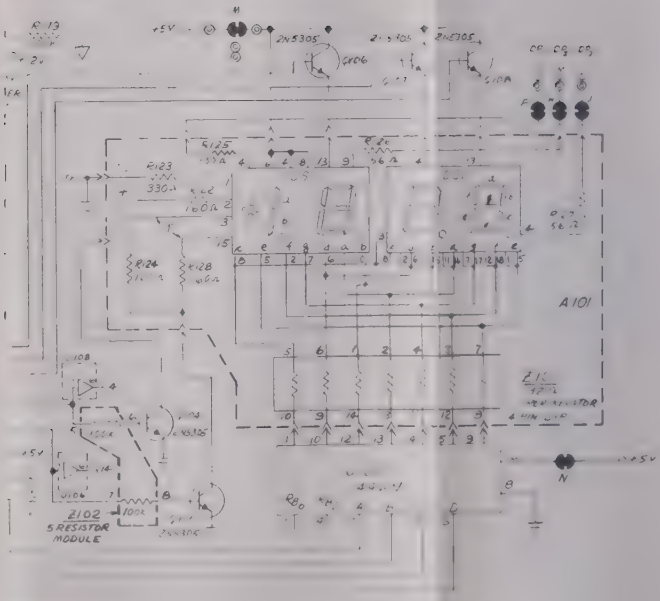



**Figure 6, Waveforms**

The conversion, which occur approximately every 450m sec, begins with the generation of a start pulse from the digital to the linear chip. This switches on the current from the V-I converter, which is proportional to input signal, and the capacitor begins to discharge from its normal level. After 2000 counts (16.6m sec or 20m sec depending on a 50 or 60 Hz line frequency) the falling edge of the full scale pulse causes the logic in the linear chip to switch off the current from the V-I converter and switch on the reference current. The integrator capacitor then begins to charge back up and at the same time the counters are enabled to begin counting clock pulses. When the voltage on the integrator capacitor reaches its original value the comparator output causes the logic of the digital chip to stop the counters and transfer the BCD information into the storage registers. The print command pulse, which confirms this transfer, occurs at this time.


LINEAR I.C.
U101
(XU101)
DIGITAL I.C.
U102
(XU102)
RANGED INPUT
HI INPUT
LO INPUT
R104 47K
R105 150K
Q101 2N5305
Q110 2N2712
Q109 2N2712
C101 .22UF
R108 47K
Z102
C105 33PF
T101
C107 .001 UF
C108 .001UF
C109 .001 UF
C113 .001 UF
C117 33PF
C118 33PF
C119 .01UF
R114 C106
4.7Ω .68UF
R115 11.8K
R116 F.S. ADJ 1K
R117 ZERO ADJ 50K
R106
MPS 5010
TO POWER SUPPL
+5V
HOLD EX START
GATED CLOCK
F.S.
START
CLOSE
POLARITY
MASTER OSC
800 HZ OSC
R110 619K
R111 PER TABLE 4
C102 200PF
R112 91.6K
C103 .68PF
POLARITY
1000
OUT
RANGE
U108
U107
U106
VIEW 'A'
CONNECTIONS FOR 220/240VAC TRANSFORMER
T102
117/234 VAC
50-60 HZ
1/4 AMP
CR101
SEE VIEW 'A' FOR
220/240 VAC TRANSFORMER




NOTES

1. FOR 117VAC OPERATION PADS A,C,E ARE CLOSED
   FOR 234VAC OPERATION PADS A,D ARE CLOSED
   FOR 220VAC OPERATION PAD B IS CLOSED
   FOR 240VAC OPERATION PAD A IS CLOSED
   SEE TABLE 4 FOR TRANSFORMER

SOLDER PAD

PAD SEE TABLE 4

PAD FOR OPTIONAL U5

CIRCUITS U106,U107, ONLY

LOGIC GROUND

SIGNAL GROUND

EARTH GROUND & SHI

**Figure 7. Schematic Diagram**



1E

# TABLE 4
## RANGING COMPONENTS

| RANGE | AC LINE | T102 | PAD P | R101 (2 Req'd) | R102 | R111* |
|---|---|---|---|---|---|---|
| 100mV | 117V | 278338-901 | BRIDGED | — | — | 278440-902 |
| 100mV | 234V | 278338-901 | BRIDGED | — | — | 278440-902 |
| 100mV | 220V | 278338-902 | BRIDGED | — | — | 278440-913 |
| 100mV | 240V | 278338-902 | BRIDGED | — | — | 278440-913 |
| 1V | 117V | 278338-901 | OPEN | — | — | 278440-902 |
| 1V | 234V | 278338-901 | OPEN | — | — | 278440-902 |
| 1V | 220V | 278338-902 | OPEN | — | — | 278440-913 |
| 1V | 240V | 278338-902 | OPEN | — | — | 278440-913 |
| 10V | 117V | 278338 901 | BRIDGED | 270197-001 | 269884 001 | 278440 902 |
| 10V | 234V | 278338 901 | BRIDGED | 270197 001 | 269884 001 | 278440 902 |
| 10V | 220V | 278338 902 | BRIDGED | 270197 001 | 269884 001 | 278440 913 |
| 10V | 240V | 278338 902 | BRIDGED | 270197 001 | 269884 001 | 278440 913 |
| 100V | 117V | 278338 901 | OPEN | 270197 001 | 269884 001 | 278440 902 |
| 100V | 234V | 278338 901 | OPEN | 270197 001 | 269884 001 | 278440 902 |
| 100V | 220V | 278338 902 | OPEN | 270197 001 | 269884 001 | 278440 913 |
| 100V | 240V | 278338 902 | OPEN | 270197-001 | 269884 001 | 278440 913 |

* R111 sets the master clock frequency to 100 kHz for 50Hz or 400 Hz power, or to 120 kHz for 60 Hz power maximizing normal mode rejection.

# TABLE 5
## COMPONENT DESCRIPTION

| PART NUMBER | DESCRIPTION |
|---|---|
| 269884-001 | RESISTOR, 49.9k ohms ± 1%, 1/8 Watt |
| 270197-001 | RESISTOR, 2.49 M ohms ± 1%, 3 4 Watt |
| 278338 901 | TRANSFORMER, 117 234 VAC Primary |
| 278338 902 | TRANSFORMER, 220 240 VAC Primary |
| 278440-902 | RESISTOR, 10.2k ohms ± 1%, 1/4 Watt |
| 278440-913 | RESISTOR, 13.3k ohms ± 1%, 1/4 Watt |

# DRAWINGS AND PARTS LIST

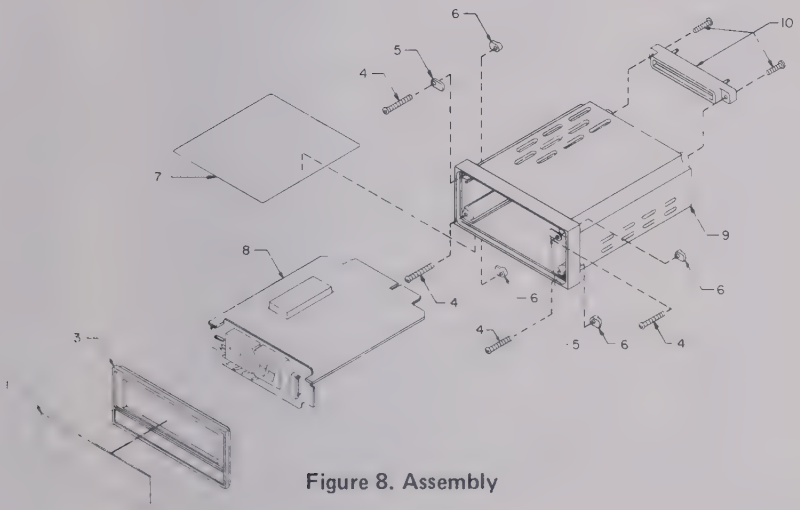
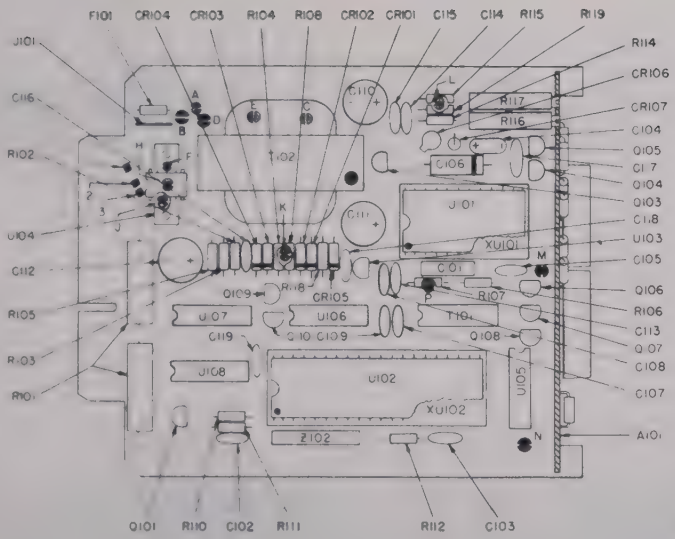
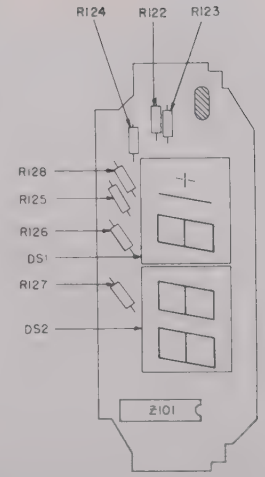



**Figure 8. Assembly**

| ITEM NUMBER NUMBER | DESCRIPTION | PART NUMBER |
|---|---|---|
| | ASSEMBLY (Ref. Figure 8) | |
| 1 | WINDOW | 278097-901 |
| 2 | DELETED | |
| 3 | FRONT | 265657-001 |
| 4 | SCREW (Panel Mtg) | 266623-045 |
| 5 | CLAMP, CIRCUIT BOARD | 265663-001 |
| 6 | CLAMP, PANEL MTG | 265661-024 |
| 7 | LABEL (117V) | 278339-901 |
| 7 | LABEL (220V) | 278339-902 |
| 7 | LABEL (240V) | 278339-903 |
| 7 | LABEL (234V) | 278339-904 |
| 8 | BOARD ASSY (See Figure 9) | — |
| 9 | CASE | 265658-001 |
| 10 | CONNECTOR PACKAGE (Optional) | 267253 901 |




A101 REF

NOTES:

1. MICROCIRCUITS U106,U107,U108 USED IN MODEL 2462 & 2464 ONLY.
2. ● PADS ON TOP OF BOARD
3. ◍ PADS ON BOTTOM OF BOARD
4. ■ PADS 1,2,3 USED FOR OPTIONAL WIRING OF EDGE CONNECTOR TABS P,M,L RESPECTIVELY

**Figure 9. Board Assembly**

| REFERENCE SYMBOL | DESCRIPTION | PART NUMBER |
|---|---|---|
| | BOARD ASSY (Ref. Figure 9) | |
| A101 | BOARD ASSY, DISPLAY (See sep. list for details) | 278330-901 |
| C101 | CAPACITOR, 0.22μF ± 20%, 50W VDC | 275523-001 |
| C102 | CAPACITOR, 200pF ± 10%, 1000W VDC | 266542-001 |
| C103 | CAPACITOR, 680pF ± 20%, 1000W VDC | 278196-001 |
| C104 | CAPACITOR, 15μF ± 20%, 10W VDC | 269951-001 |
| C105 | CAPACITOR, 33pF ± 10%, 1000W VDC | 275553-001 |
| C106 | CAPACITOR, 0.68μF ± 20%, 50W VDC | 270034-001 |
| C107 | CAPACITOR, 0.001μF ± 10%, 1000W VDC | 266417-001 |
| C108 | CAPACITOR, 0.001μF ± 10%, 1000W VDC | 266417-001 |
| C109 | CAPACITOR, 0.001μF ± 10%, 1000W VDC | 266417-001 |
| C110 | CAPACITOR, 100μF, 50W VDC | 275630-001 |
| C111 | CAPACITOR, 100μF, 50W VDC | 275630-001 |
| C112 | CAPACITOR, 470μF + 50% - 10%, 16W VDC | 278188-001 |
| C113 | CAPACITOR, 0.001μF ± 10%, 1000W VDC | 266417-001 |
| C114 | CAPACITOR, 0.01μF + 80% - 20%, 50W VDC | 269899-001 |
| C115 | CAPACITOR, 0.01μF + 80% - 20%, 50W VDC | 269899-001 |
| C116 | CAPACITOR, 0.1μF + 80% - 20%, 10W VDC | 272376-001 |
| C117 | CAPACITOR, 33pF ± 10%, 1000W VDC | 275553-001 |
| C118 | CAPACITOR, 33pF ± 10%, 1000W VDC | 275553-001 |
| C119 | CAPACITOR, 0.01μF + 80% - 20%, 50W VDC | 269899-001 |
| CR101 | DIODE, 1N914 | 61025-001 |
| CR102 | DIODE, 1N914 | 61025-001 |
| CR103 | DIODE, 1N4004 | 278161-001 |
| CR104 | DIODE, 1N4004 | 278161-001 |
| CR105 | DIODE, 1N914 | 61025-001 |
| CR106 | DIODE, MPS5010 | 278349-901 |
| CR107 | DIODE, 1N4693 | 278291-001 |
| F101 | FUSE, PICO, 1/4 AMP, 125 VOLTS* | 268798-001 |
| J101 | WIRE, JUMPER | 265551-903 |
| Q101 | TRANSISTOR, 2N5305 | 275559-001 |
| Q103 | TRANSISTOR, 2N5354 | 268795-001 |
| Q104 | TRANSISTOR, 2N5305 | 275559-001 |
| Q105 | TRANSISTOR, 2N5305 | 275559-001 |
| Q106 | TRANSISTOR, 2N5305 | 275559-001 |
| Q107 | TRANSISTOR, 2N5305 | 275559-001 |
| Q108 | TRANSISTOR, 2N5305 | 275559-001 |
| Q109 | TRANSISTOR, 2N2712 | ND39917-001 |
| Q110 | TRANSISTOR, 2N2712 | ND39917-001 |

*Note Fuse replacement should be made only with the same type as listed.

| REFERENCE SYMBOL | DESCRIPTION | PART NUMBER |
|---|---|---|
| | BOARD ASSY (Continued) | |
| R101 | RESISTOR (Ref. Table 4) | – |
| R102 | RESISTOR (Ref. Table 4) | – |
| R103 | RESISTOR 100k ohms ± 5%, 1/4 Watt | 278433-917 |
| R104 | RESISTOR 47k ohms ± 5%, 1/4 Watt | 278433-909 |
| R105 | RESISTOR 100k ohms ± 5%, 1/4 Watt | 278433-917 |
| R106 | RESISTOR 2k ohms ± 1%, 1/10 Watt | 272616-001 |
| R107 | RESISTOR 18k ohms ± 1%, 1/10 Watt | 278178-001 |
| R108 | RESISTOR 47k ohms ± 5%, 1/4 Watt | 278433-909 |
| R110 | RESISTOR 61.9k ohms ± 1%, 1/4 Watt | 278440-977 |
| R111 | RESISTOR (Ref. Table 4) | – |
| R112 | RESISTOR 91.0k ohms ± 5%, 1/4 Watt | 278433-940 |
| R114 | RESISTOR 4.7 ohms ± 5%, 1/4 Watt | 278432-909 |
| R115 | RESISTOR 11.8k ohms ± 1%, 1/10 Watt | 278184-001 |
| R116 | RESISTOR, VARIABLE, 1k ohm ± 10%, 1 Watt | 278126-001 |
| R117 | RESISTOR, VARIABLE, 50k ohms ± 10%, 1 Watt | 278174-001 |
| R118 | RESISTOR, 10k ohms ± 5%, 1/4 Watt | 278432-989 |
| R119 | RESISTOR, 100k ohms ± 5%, 1/4 Watt | 278433-917 |
| T101 | TRANSFORMER, PULSE | 278341-901 |
| T102 | TRANSFORMER (Ref. Table 4) | – |
| U101 | MICROCIRCUIT, ANALOG | 278344-001 |
| U102 | MICROCIRCUIT, DIGITAL | 278343-001 |
| U103 | MICROCIRCUIT, VOLT. REG. 78L12 | 278176-001 |
| U104 | MICROCIRCUIT, VOLT. REG. 78MG | 278173-001 |
| U105 | MICROCIRCUIT, 7446N | 272729-001 |
| U106* | MICROCIRCUIT, HEX BUFFER | 278177-001 |
| U107* | MICROCIRCUIT, HEX BUFFER | 278177-001 |
| U108* | MICROCIRCUIT, HEX BUFFER | 278177-001 |
| XU101 | SOCKET, 24 PIN | 278175-001 |
| XU102 | SOCKET, 40 PIN | 278165-001 |
| Z102 | RESISTOR, MODULE | 278348-001 |
| – | BOARD, DRILLED | 278332-901 |

*Used in meters with buffered BCD

| REFERENCE SYMBOL | DESCRIPTION | PART NUMBER |
|---|---|---|
| | DISPLAY BOARD ASSY (Ref. Figure 9) | |
| DS1 | DISPLAY, NUMERIC, 1-1/2 Digit | 278346-901 |
| DS2 | DISPLAY, NUMERIC 2 Digit | 278345-901 |
| R122 | RESISTOR, 160 ohms ± 5%, 1/4 Watt | 278432-946 |
| R123 | RESISTOR, 330 ohms ± 5%, 1/4 Watt | 278432-953 |
| R124 | RESISTOR, 160 ohms ± 5%, 1/4 Watt | 278432-946 |
| R125 | RESISTOR, 330 ohms ± 5%, 1/4 Watt | 278432-953 |
| R126 | RESISTOR, 56 ohms ± 5%, 1/4 Watt | 278432-935 |
| R127 | RESISTOR, 56 ohms ± 5%, 1/4 Watt | 278432-935 |
| R128 | RESISTOR, 160 ohms ± 5%, 1/4 Watt | 278432-946 |
| Z101 | RESISTOR, MODULE, 7-32 ohms | 278183-001 |
| — | BOARD, DRILLED | 278329-901 |

# WESTON EQUIPMENT WARRANTY

Weston warrants equipment of its manufacture against defective materials or workmanship for a period of one year from date of shipment.

The liability of Seller under this warranty is limited, at Seller's option, solely to repair, replacement with equivalent Weston equipment, at an appropriate credit adjustment not to exceed the original equipment sales price, of equipment returned to the Seller provided that (a) Seller is promptly notified in writing by Buyer upon discovery of defects, (b) Upon receipt of written authorization from Seller the defective equipment is returned as directed, transportation charges prepaid by Buyer, and (c) Seller's examination of such equipment discloses to his satisfaction that defects were not caused by negligence, misuse, improper installation, accident, or unauthorized repair or alteration by the Buyer.

This warranty does not include mechanical parts failing from normal usage nor does it cover limited life electrical components which deteriorate with age such as tubes, lamps, etc.

This warranty is in lieu of all other warranties, expressed or implied, including the implied warranty of fitness for a particular purpose to the original purchaser or to any other person. Seller shall not be liable for consequential damages of any kind.

The aforementioned provisions do not extend the original warranty period of any article which has been either repaired or replaced by Seller.

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